# PATENT SPECIFICATION 748,966

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COMPLETE SPECIFICATION.

## Improvements in Aircraft.

I, NORMAN MCGLASHAN, a Citizen of the United States of America, of 38-30 Douglaston Parkway, Douglaston 63, Long Island, New York, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:

The chief object of the invention is to evolve an aircraft which will have the advantages of controlled vertical ascent and descent and ability to hover, with the high forward speed characteristics and high degree of manoeuvreability of normal high speed aircraft.

An aircraft in accordance with the present invention includes a circular wing of bi-convex or discus form in cross section and comprising a central non-rotatable circular part or fuselage and an outer non-rotatable annular rim and a bladed lift rotor or rotors revolvably mounted between said central part and rim, the blades of said rotor or rotors being movable from a position occupied in forward flight in which they form part of the upper and lower surfaces of the wing to a vertical flight position in which they each have a positive angle of incidence or attack so that the rotor or rotors when driven at the desired rotational speed will impart vertical lift to the aircraft, means for driving said rotor or rotors and means for propelling said aircraft in a forward direction.

It is preferred that during take-off and landing the rotor blades are pre-set to a suitable angle if incidence or attack and when the aircraft has reached the altitude required for normal forward flight the propulsion means provided for forward flight is started up, the rotation of the rotor being then stopped, the rotor blades being moved angularly to a position in which they lie in a common plane to form a single fixed low drag aerofoil.

Referring to the drawings:—

Figure 1 is a plan view of an aircraft in accordance with the invention;

Figures 2 and 3 are respectively a rear elevation and side elevation;

Figures 4 and 5 are sectional views diagrammatically illustrating details of construction, Figure 5 being a section on the line A—B in Figure 1.

The aircraft illustrated includes a circular wing of bi-convex or discus form in cross section which includes a central fixed structure 1 forming a fuselage or body of annular form, carrying a cockpit enclosure 2, and a surrounding fixed annular ring 3 which is spaced from the fuselage 1 but is connected therewith by a pair of parallel vertically positioned fins 4 which may include rudders or the like for directional control during forward flight, and also by a series of radially arranged stays or stiffeners 5. The annular ring 3 is of substantially "V" shape in cross section so as to offer a minimum of air resistance.

The two fins 4 which project upwardly and downwardly from the fuselage in addition to providing the requisite lateral side area also act as aerodynamic fences, the upper fins carrying between them a horizontal stabilising surface 6 which is preferably of bi-convex high speed aerofoil cross section the surface incorporating a horizontal control surface 6*a* which is linked with flight controls in the cockpit disposed beneath the cockpit enclosure 2. The surface 6*a* may be divided centrally as shown so that the two parts can be moved differentially, thereby functioning as elevons.

The two fins carry near their rearward extremities suitably arranged jet reaction propulsion units 7 which may be of any desired form and which are brought into operation for forward flight.

[*Price* 3*s.* 0*d.*]

The annular rotor which is mounted for rotational movement between the fixed fuselage 1 and the annular fixed ring 3 is designated generally by reference numeral 8 and as is clearly shown in Figures 2 and 3 in conjunction with the annular ring or rim and fuselage provides a fixed wing when the rotor is at rest of bi-convex or discus sectional form so as to offer a minimum of drag in forward flight.

It is proposed that the rotor shall be built up of upper and lower sets 9 and 10 of radially arranged blades which when the rotor is at rest comprise or form part of the upper and lower surfaces of the fixed aerofoil. These blades 9 and 10 are capable of angular adjustment from a position in which the blades comprising each set lie in a common plane to a position in which they have a suitable positive angle of incidence or attack to impart a vertical lift to the aircraft when the rotor is driven at an appropriate speed.

It is proposed that the rotor shall only be rotated when it is desired to use it in a direct lifting sense for take-off, landing and hovering purposes and in the case of an "engine off" landing which might be necessary owing to engine failure the blades may be moved automatically or otherwise into a position in which they have a smaller angle of attack than normally so that the rotor will autorotate and generate sufficient lift to permit a safe landing to be made.

As will be seen clearly from Figure 1 the blades 9 of the upper set are separated from one another by intermediate blade-like surfaces 9*a*, similar surfaces being interposed between the blades comprising the lower set. The surfaces 9*a* and the corresponding surfaces on the lower face of the rotor rotate with the blades 9 and 10 but are not angularly adjustable, the surfaces 9*a* having a zero angle of incidence.

It is preferred that the rotor shall be driven by a series of jets which may either be fixed in which case the compressed gases issuing from the jet orifices will impinge on the blades to cause them to rotate, or alternatively the jets may be carried by or otherwise rotate with the blades, the gases issuing from the jet orifices reacting to produce rotation. The former arrangement has the advantage of simplifying the supply of compressed gases to the jet orifices as a fixed annular ring-like combustion chamber, such as is indicated by reference numeral 12 may be mounted in the fuselage from which project radial jet pipes 11 leading to the jet orifices, the orifices being so arranged that the issuing gases will impinge on the blades, the jet pipes being so positioned that they do not interfere with the free rotation of the blades.

The second arrangement has the advantage of avoiding torque reaction and in such a case the jet orifice may take the form of small orifices formed in the trailing edges of the blades.

In either case the combustion chamber can be supplied with compressed air from a suitable compressor driven by an auxiliary engine or turbine in the fuselage, fuel being injected into the combustion engine and burnt, the exhaust efflux issuing from the jet orifices to drive the rotor at the required rotational speed.

The blades 9 and 10 included in the upper and lower sets are preferably movable from the full line position shown in Figure 4 for forward flight into the dotted line position in which they lie substantially parallel with one another. Each upper blade and its opposite lower blade therefore when moved towards one another form virtually a single composite blade. The upper and lower components may actually come into engagement to provide a single blade of suitable aerofoil section.

One method of moving the blades into and out of the position which they occupy for rotation is shown diagrammatically in Figures 1 and 5. The blades are provided with trunnions 13 and 13*a* at their opposite ends. The outer trunnion 13*a* slides in an inclined slot 14 against the action of a spring as a result of pressure being applied to the inner trunnion 13 which acts as a lever. The pressure which is employed to move each blade into the required position may be produced with the aid of compressed air bypassed from the compressor or some form of mechanical linkage may be used likewise under the control of the pilot. The arrangement may be such that the blades will be moved into an inclined position simultaneously with them being moved into their operative position. The angle of attack may be fixed or variable under the control of the pilot.

Although it is thought unnecessary to employ any means for resisting torque of the revolving rotor if the jets rotate with the rotor, in the case of a fixed set system it is within the scope of the invention to employ two rotors arranged one above the other and revolving at different speeds or in opposite directions and in such a case one or both of the two rotors may be driven by some suitable mechanical drive instead of by means of jets which drive may be obtained, for example, from a piston driven engine or engines mounted in the fuselage.

The lower vertical fins may be formed to provide landing skids whilst the fuselage may carry a suitable form or forms of wheeled undercarriage which are preferably retractable into the fuselage after take-off.

As it is anticipated that the aircraft will be capable of very high forward speed it is

proposed that the cockpit canopy shall be capable of retraction so that it may more nearly lie flush with the upper surface of the circular fuselage.

Although it is proposed that the aircraft shall take off and land vertically under the control of the rotor or rotors the jet reaction units carried by the fins not being used during take-off and landing, it is within the scope of the invention to utilise the rotor in conjunction with the jet reaction units to provide a high angle climb in which case it will probably be desirable to provide some form of cyclic pitch control for varying the angle of incidence or angle of attack of the forwardly and rearwardly moving blades of the rotor.

It will be appreciated that an aircraft in accordance with the invention combines in one machine means for rising from the ground vertically or substantially vertically and then flying forwardly from such an airborne position by other and entirely separate means and without the use of propellers for generating the necessary forward thrust or additional conventional type wings provided for giving the requisite lift when the aircraft is moving in a forward direction.

What I claim is:—

1. An aircraft including a circular wing of bi-convex or discus form in cross-section and comprising a central non-rotatable circular part or fuselage and an outer non-rotatable annular rim spaced therefrom and a bladed lift rotor or rotors revolvably mounted between said central part and rim, the blades of said rotor or rotors being movable from a position occupied in forward flight in which they form part of the upper and lower surfaces of the wing to a vertical flight position in which they each have a positive angle of incidence or attack so that the rotor or rotors when driven at the desired rotational speed will impart vertical lift to the aircraft, means for driving said rotor or rotors and means for propelling said aircraft in a forward direction.

2. An aircraft as claimed in Claim 1 wherein the blades forming the rotor or rotors are separated from one another by intermediate blade-like surfaces which rotate with the blades but have a zero angle of incidence.

3. An aircraft as claimed in Claim 1 or 2 including one or more vertical fins connecting the central fixed part of the wing with the rim and providing longitudinal directional control during forward flight.

4. An aircraft as claimed in Claim 3 wherein the fin or fins carry a horizontal stabilising surface for use during forward flight and for control of the aircraft in the pitching plane.

5. An aircraft as claimed in Claim 3 or 4 wherein the fin or fins carry one or more jet reaction propulsion units for forward flight.

6. An aircraft as claimed in any of the preceding claims, wherein the lift rotor or rotors are rotatably driven by jet reaction.

7. An aircraft as claimed in any of Claims 1 to 5 wherein the lift rotor or rotors is or are driven by gases issuing from jet orifices associated with the fuselage, the gases impinging on the rotor blades.

8. An aircraft as claimed in Claim 6 or 7 including suitably positioned jet nozzles connected with an annular combustion chamber to which air under pressure is supplied from a compressor, means being provided for the injection of fuel into the combustion chamber and for igniting the combustible mixture.

9. An aircraft substantially as hereinbefore described with reference to the accompanying drawings.

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## PROVISIONAL SPECIFICATION.

## Improvements in Aircraft.

I, NORMAN MCGLASHAN, a Citizen of the United States of America, of 38-30 Douglaston Parkway, Douglaston 63, Long Island, New York, United States of America, do hereby declare this invention to be described in and by the following statement:—

The chief object of the invention is to evolve an aircraft which will have the advantages of controlled vertical ascent and descent and ability to hover at present only associated with helicopters, with the high forward speed characteristics and high degree of manoeuvreability of normal high speed aircraft.

An aircraft in accordance with the present invention includes an annular bladed lift rotor which when driven at the requisite rotational speed will be capable of imparting lift to the aircraft without forward motion and when at rest will constitute a section or component of a fixed circular wing for forward flight, means for driving said rotor and means for propelling said

aircraft through the air in a forward direction when said rotor is stationary.

It is proposed to arrange the blades of the rotor in such manner that they can be moved into either a position in which they each have a positive angle of attack and are spaced apart to permit the flow of air therebetween, thus generating lift when driven at the requisite speed, or a position in which they lie in juxtaposition in a common plane and provide a single fixed annular aerofoil preferably of biconvex section which will offer a minimum of drag in the direction of the line of flight.

During take-off and landing the rotor blades are pre-set to a suitable angle of incidence or attack and when the aircraft has reached the altitude required for normal forward flight the propulsion means provided for forward flight is started up, the rotation of the rotor being then stopped, the rotor blades being moved angularly to a position in which they lie in a common plane to form a single fixed low drag aerofoil.

It is proposed that the aircraft shall include a fixed body or fuselage component of annular disc-like form around which the rotor, also of circular shape, is adapted to rotate within and suspended from an outer ring which is attached to the central circular fuselage.

It is proposed that the centrally positioned fuselage or body shall carry a pair of parallel vertically positioned fins, attached also to said ring, and which project upwardly and downwardly from the fuselage and provide the requisite lateral side area, the lift available from the circular aerofoil being augmented by the two vertical fins acting as aerodynamic fences. The upper fins carry between them a horizontal stabilising surface which is again preferably of biconvex high speed aerofoil cross section, the surface incorporating hinged flaps or control surfaces which are linked with flight controls in a cockpit associated with the fuselage, the surfaces serving the function by virtue of their differential operation of elevators, ailerons and rudder.

The annular rotor consists of a series of blades which are radially arranged and are disposed in edge-to-edge relationship around the fixed fuselage, the blades being capable of angular adjustment so that they can be moved from a position in which they lie in a common plane to a position in which they have a suitable angle of incidence or attack for the purpose of imparting a vertical lift to the aircraft when driven at an appropriate speed. It is proposed that the blades shall only be used in a direct lifting sense for take-off, landing and hovering purposes and it will be appreciated that in the case of an "engine off" landing being necessary the blades may be moved into a position in which they have a smaller angle of incidence than normal so that the rotor will autorotate and permit a safe landing to be made.

It is proposed that the rotor shall be driven by means of a series of jets which may be tangentially or otherwise associated with the blades, the fuselage containing an auxiliary engine driving a suitable compressor which supplies compressed air to an annular or other combustion chamber or chambers into which is injected liquid fuel which is burnt, the issuing jets serving to drive the rotor at the desired operational speed.

It will be appreciated that the fixed aerofoil will be composed of the central fixed fuselage or body, the surrounding annular rotor and its bordering ring or rim, this aerofoil surface, as previously stated, being preferably of biconvex sectional form so as to offer a minimum of drag in forward flight.

It is proposed, therefore, that each blade shall include upper and lower components which will be moved inwardly towards one another to make a single blade of suitable aerofoil section and that when the aircraft is to be propelled forwardly that these two components shall be moved apart into a position in which they lie in line with and form a continuation of the upper and lower surfaces of the fixed fuselage.

Although it is thought unnecessary to employ any means for resisting torque of the revolving rotor by virtue of the fact that it is jet driven, it is within the scope of the invention to employ two rotors arranged one above another and revolving at different speeds or in opposite directions and for such a case one or both of the two rotors may be driven by some suitable mechanical drive which may be obtained, for example, from a piston driven engine or engines mounted in the fuselage.

For the purpose of forward propulsion it is proposed that the vertical fins shall carry at or near their rearward extremities suitably arranged jet reaction propulsion units which may be of any desired form.

The lower vertical fins may be formed to provide landing skids whilst the fuselage may carry a suitable form or forms of wheeled undercarriage which are preferably retractable into the fuselage after take-off.

As it is anticipated that the aircraft will be capable of very high forward speed it is proposed that the cockpit canopy shall be capable of retraction so that it may more nearly lie flush with the upper surface of the circular fuselage.

Although it is proposed that the aircraft shall take off and land vertically under the control of the rotor or rotors the jet reaction units carried by the fins not being used during take-off and landing, it is within the scope of the invention to utilise the rotor in

conjunction with the jet reaction units to provide a high angle climb in which case it will probably be desirable to provide some form of cyclic pitch control for varying the angle of incidence or angle of attack of the forwardly and rearwardly moving blades of the rotor.

It will be appreciated that an aircraft in accordance with the invention virtually covers a new principle of aeroplane operation by combining in one machine means for rising from the ground vertically or substantially vertically and then flying forwardly from such an airborne position by other and entirely separate means and without the use of propellers for generating the necessary forward thrust or additional conventional type wings provided for giving the requisite lift when the aircraft is moving in a forward direction.

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748,966 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

FIG. 1.

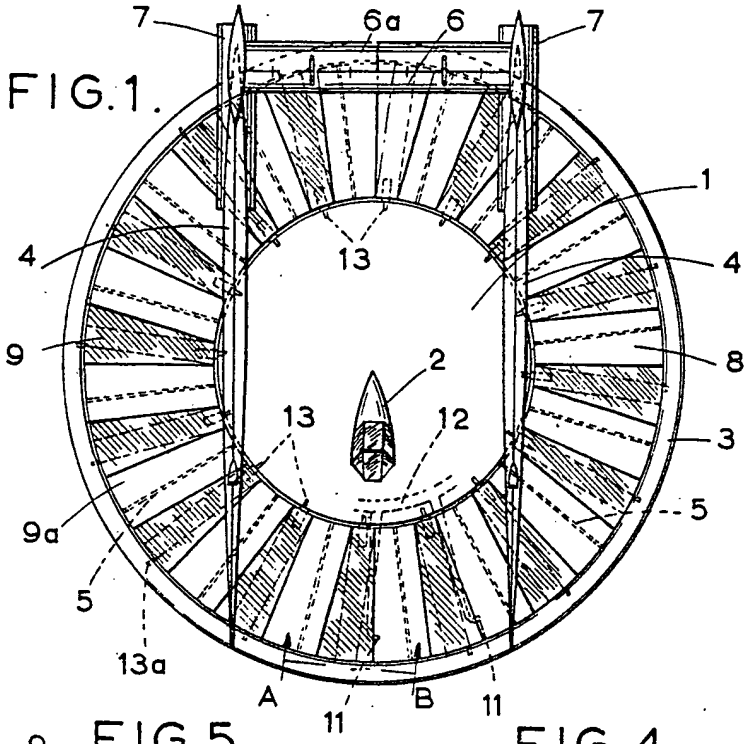


FIG. 5.

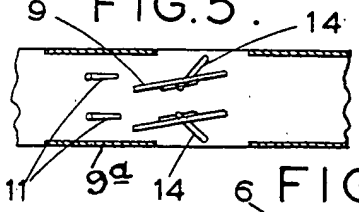


FIG. 4.

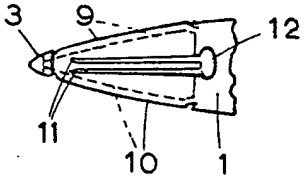


FIG. 2.

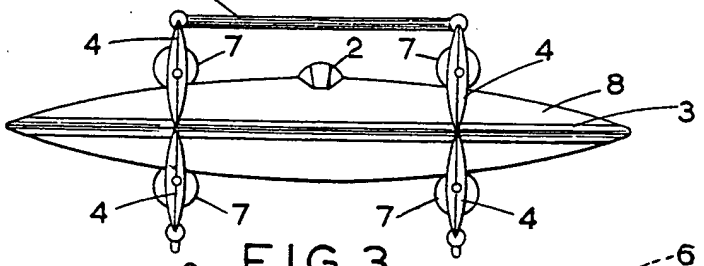


FIG. 3.